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# Surface Impoundment Modeling System (SIMS), User's Manual

Radian Corp., Research Triangle Park, NC

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Surface impoundments are used to tr.. t, store, and dispose of waste water generated by facilities in many different industries. Because surface impoundments are normally open to the atmosphere, the potential for air emissions of volatile organic compounds (VOC's) and toxic air pollutants exists. As, such state and local air pollution control agencies need a methodology to estimate the air emissions from surface impoundments.

The Surface Impoundment Modeling System (SIMS) is a personal computer based program designed to estimate the air emissions from surface impoundments. The emission estimates are based on mass transfer models developed by the Emissions Standards Division (ESD) of the Environmental Protection Agency (EPA) during the evaluation of hazardous waste treatment, storage, and disposal facilities (TSDF's).

SIMS allows the user to specify all required inputs to these emission models when this information is available, or when only limited information is available, provides default values for most of the model inputs. This manual resents a complete reference for all of the features and commands in SIMS. Another document enitled, Background Document for the SIMS, EPA-450/4-89-013b, discusses the emission models, surface impoundment design and operation, defaualt parameter development and the emission proedure.

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# Surface Impoundment Modeling System (SIMS) User's Manual

control technology center

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# SURFACE IMPOUNDMENT MODELING SYSTEM (SIMS) USER'S MANUAL

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Office Of Air Quality Planning And Standards
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

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# SURFACE IMPOUNDMENT MODELING SYSTEM (SIMS) USER'S MANUAL

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## NOTICE

This report was prepared by Radian Corporation, Research Triangle Park, NC. It has been reviewed for technical accuracy by the Emission Standards Division and the Technical Support Division of the Office Of Air Quality Planning And Standards, and the Air And Energy Engineering Research Laboratory of the Office Of Research And Development, U. S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use.

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# SECTION 1
# INTRODUCTION

Surface impoundments are used to treat, store, and dispose of wastewater generated by facilities in many different industries. These wastewater streams may contain a variety of volatile organic compounds (VOC's) and toxic air pollutants. Because surface impoundments are normally open to the atmosphere, the potential for air emissions exists. As such, state and local air pollution control agencies need a methodology to estimate the air emissions from surface impoundments.

The Surface Impoundment Modeling System (SIMS) is a personal computer based program designed to estimate the air emissions from surface impoundments. The emission estimates are based on mass transfer models developed by the Emissions Standards Division (ESD) of the Environmental Protection Agency (EPA) during the evaluation of hazardous waste treatment, storage, and disposal facilities (TSDF's). SIMS allows the user to specify all the required inputs to the ESD emission models when this information is available. Moreover, when only limited information is available, SIMS provides default values for most of the model inputs.

This manual presents a complete reference for all of the features and commands in SIMS. Section 2 explains how to install SIMS on your personal computer. Section 3 discusses the commands you need to use in the program. This manual should be thoroughly read before using SIMS.

# SECTION 2
# INSTALLATION

This section tells you how to install SIMS on your personal computer. SIMS requires DOS version 2.0 or higher, one floppy disk drive, 512 kilobytes of main memory (RAM) with 300 kilobytes free, and an IBM® PC, XT, AT, or other fully IBM compatible model of personal computer.

Before installing or using SIMS, make a backup copy of the program and its database files (SI_CHEM.DBF, SI_COMP.DBF, and SI_IND.DBF). Store this backup copy in a safe place for use only if something were to happen to your working copy of the program.

SIMS may be run either from a floppy disk or from a hard disk. However, since the computer can read information from a hard disk more quickly than from a floppy disk, it is recommended that the hard disk installation be used whenever possible.

## FLOPPY DRIVE INSTALLATION

For floppy drive use, no special installation steps are required. Simply insert a working copy of the SIMS diskette in the default drive whenever you want to run the program.

## HARD DISK INSTALLATION

To install SIMS on a hard disk, first create a directory for SIMS using the following command:

```
MD \SIMS
```

Then, copy all of the files from the SIMS diskette to the new directory by typing:

```
COPY A:*.*  \SIMS
```

Finally before trying to run the program, change to the SIMS directory by typing:

```
CD \SIMS
```

Included on the SIMS diskette is a batch file named RUNSIMS.BAT. This file may be copied to your root directory (C:\) and used to run SIMS from any directory on your hard disk. To start SIMS using this batch file, type:

```
RUNSIMS
```

# SECTION 3
# OPERATION

This section describes all of the features and commands in the Surface Impoundment Modeling System (SIMS). Hints and suggestions intended to help you take full advantage of the program also are included.

## STARTING SIMS

To start SIMS from DOS, type:

```
SIMS
```

The introductory screen presented in Figure 3-1 should appear on the computer display. Press any key to begin loading the database files. After the files have been loaded, the SIMS Main Menu should appear as shown in Figure 3-2.

Some personal computers attempt to simulate color on monochrome displays (for example, Compaq and Toshiba computers). This simulation can cause the SIMS display to look faded or to hide the cursor. If you experience either of these problems, or if the display looks unusual, try running SIMS in the monochrome mode. To start SIMS in the monochrome mode from DOS, type:

```
SIMS -M
```

## MAIN MENU

SIMS uses bar menus, which appear at the top of the computer display, to control the actions of the program. You may select an entry from the menu

SIMS
Surface Impoundment Modeling System
Sponsored by:
Control Technology Center
U. S. Environmental Protection Agency
Reasearch Triangle Park, NC 27711
Project Officer: David C. Misenheimer, USEPA
Developed by Radian Corporation
Press any key to begin...

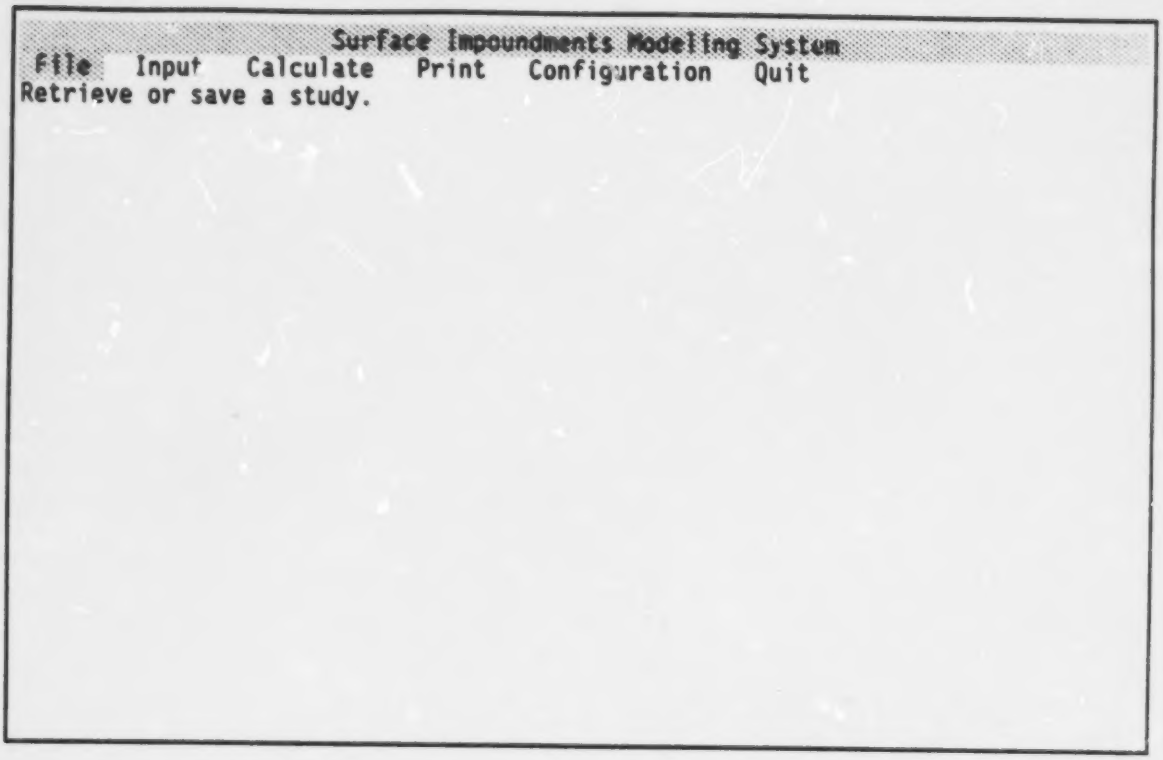


Figure 3-2. SIMS Main Menu.

either by typing the first letter or by using the cursor motion keys ([left arrow] and [right arrow]) to highlight the desired entry and pressing [Enter]. After a menu entry is selected, SIMS will either perform some action or present another menu of options (a sub-menu). To exit a sub-menu and return to the parent menu, press [Esc].

The commands available in the SIMS Main Menu are:

| | |
|---|---|
| File | Retrieves or saves study definition files. |
| Input | Specifies the input data for the calculations. |
| Calculate | Calculates the air emission estimates. |
| Print | Prints the report of the emission estimates. |
| Configuration | Updates the configuration parameters for SIMS. |
| Quit | Quits SIMS and returns to DOS. |

## FILE

This entry starts a sub-menu that controls the creation and retrieval of study definition files. A study definition file contains all the input data for a calculation. Once created, these files may be recalled and used at a later time. Figure 3-3 shows an example of the File sub-menu. The commands available in this sub-menu are:

| | |
|---|---|
| Retrieve | Retrieves an existing study file. |
| Save | Saves the current study to a file. |
| New | Deletes the current study and starts a new study. |

## FILE/RETRIEVE

File/Retrieve sets all of the calculation input parameters to the values saved in an existing study definition file. Study definition files are created with the SIMS File/Save command and have the filename extension of SDF.

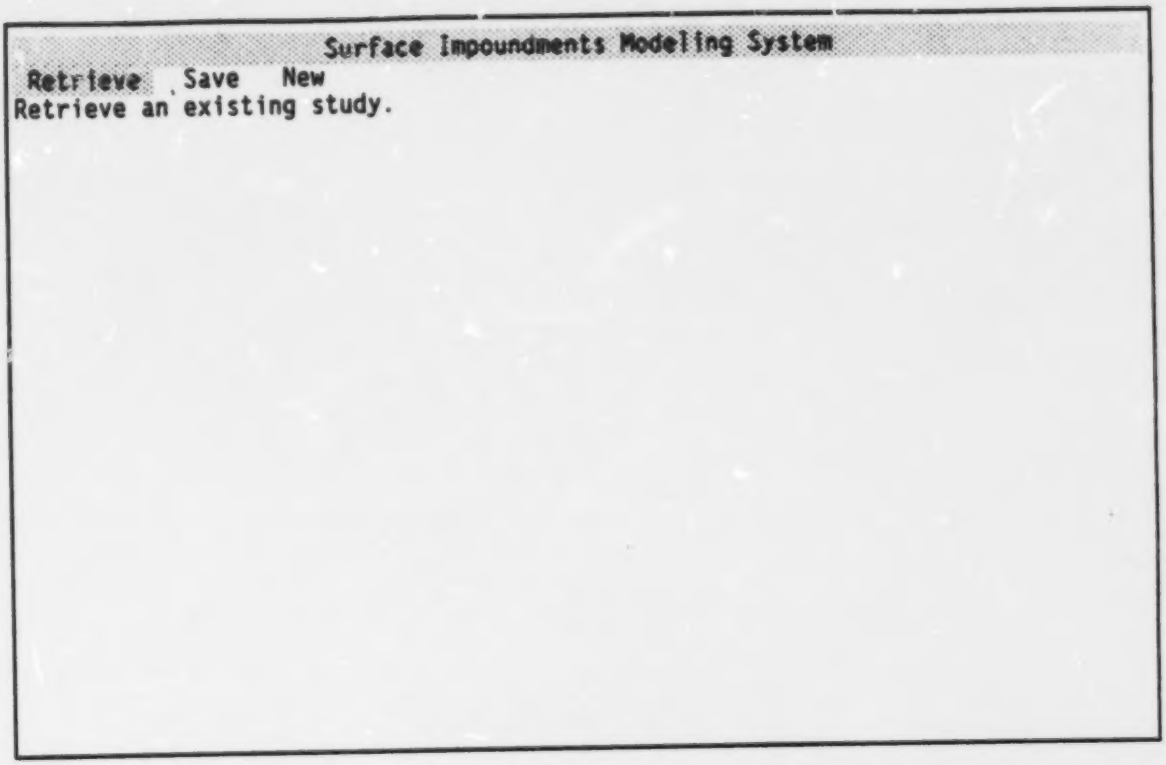


Figure 3-3. SIMS File Sub-menu.

When File/Retrieve is selected, a pop-up menu containing the study definition files located in the SIMS default directory is presented (Figure 3-4). SIMS uses pop-up menus to select items from a list of entries. Use [Up arrow] and [Down arrow] to highlight the entry you wish to select. Press [Enter] to select the item or press [Esc] to abort the menu without making a selection.

You may select an existing study file from this menu or you may abort the menu by pressing [Esc]. If you abort the menu, you will be prompted for a study file name. Continuing to press [Esc] will return you to the File sub-menu.

An example study definition file has been included on the SIMS diskette. The name of the file is EXAMPLE.SDF. If you want your computer to duplicate the example figures in the remainder of this manual, you must retrieve the EXAMPLE study file.

FILE/SAVE

File/Save copies all of the current input values to a specified study definition file. If the specified file already exists, SIMS will ask if you want to overwrite the existing file. Overwriting a file destroys the existing contents of the file.

Figure 3-5 shows the initial SIMS prompt containing the currently defined study file name. If no file name is currently defined (or if you abort the current name by pressing [Esc]), a pop-up menu of the existing study definition files is presented. As with File/Retrieve, you may select an existing file or press [Esc] to enter a new file name.

FILE/NEW

The File/New option provides you with a way to start the SIMS program from scratch without having to quit and restart the program. As shown in Figure 3-6, SIMS asks if you really want to clear the existing study. This

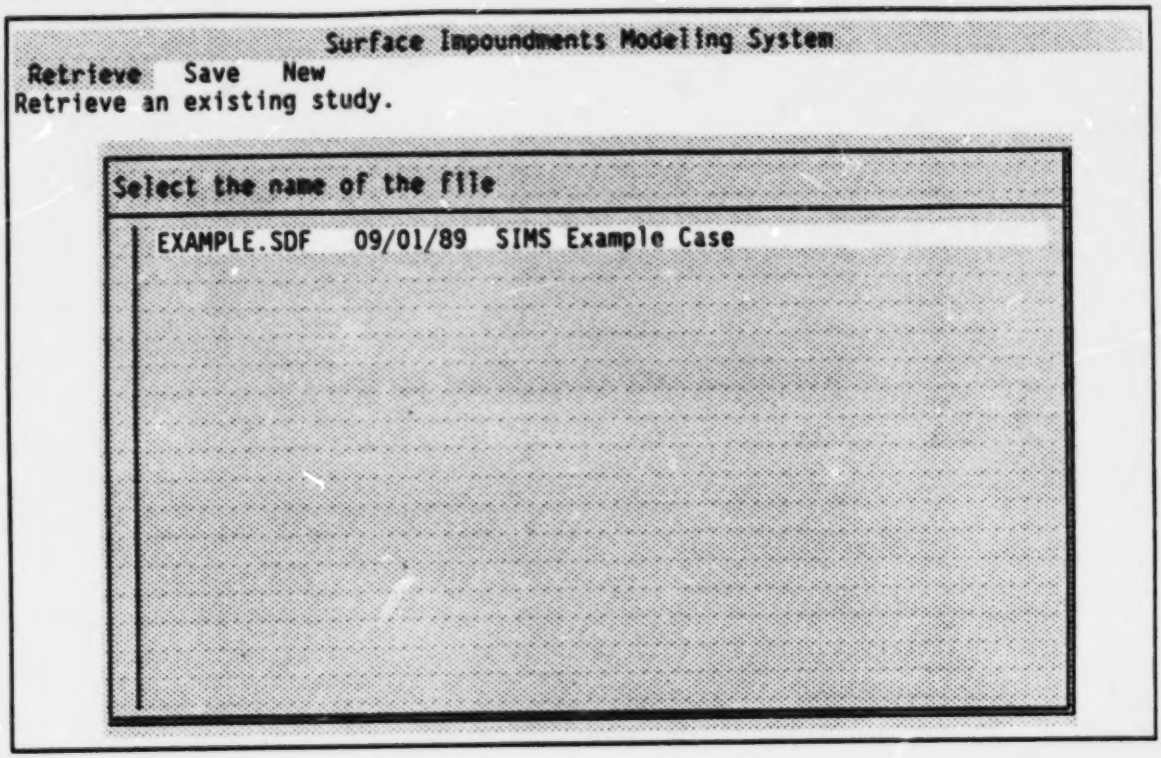
Surface Impoundments Modeling System
Retrieve Save New
Retrieve an existing study.
Select the name of the file
EXAMPLE.SDF 09/01/89 SIMS Example Case

Figure 3-4. Retrieving a Study File.

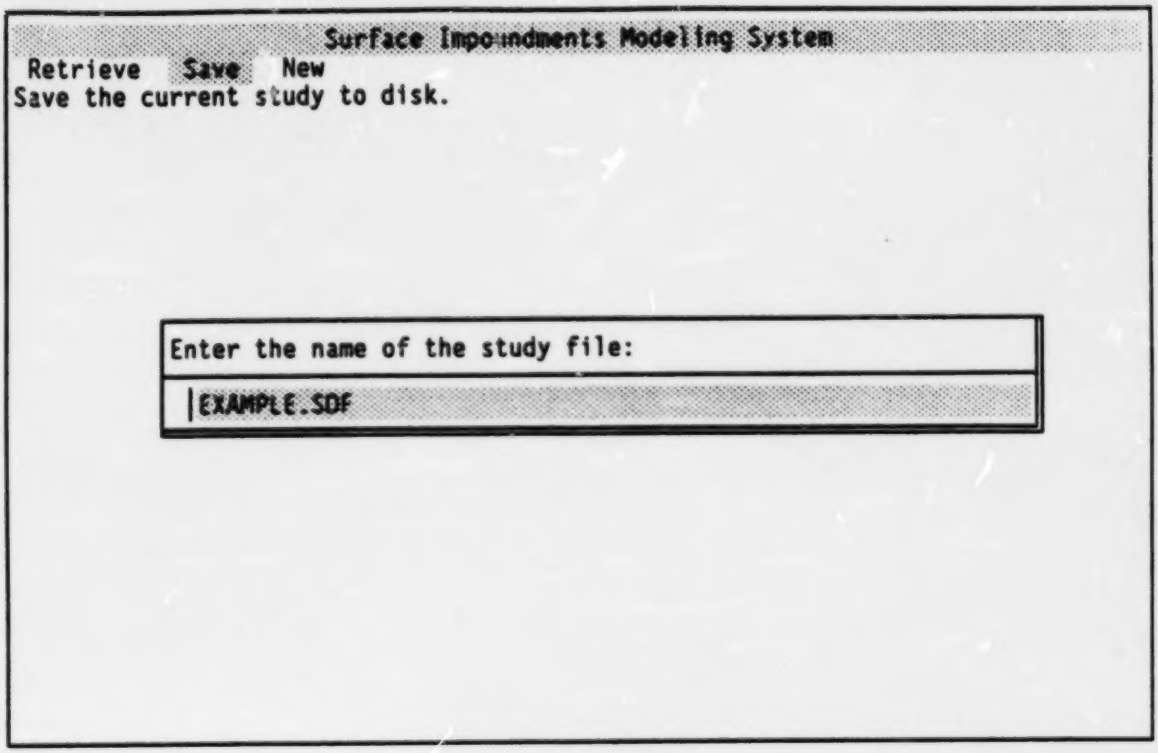


Figure 3-5. Saving a Study File.

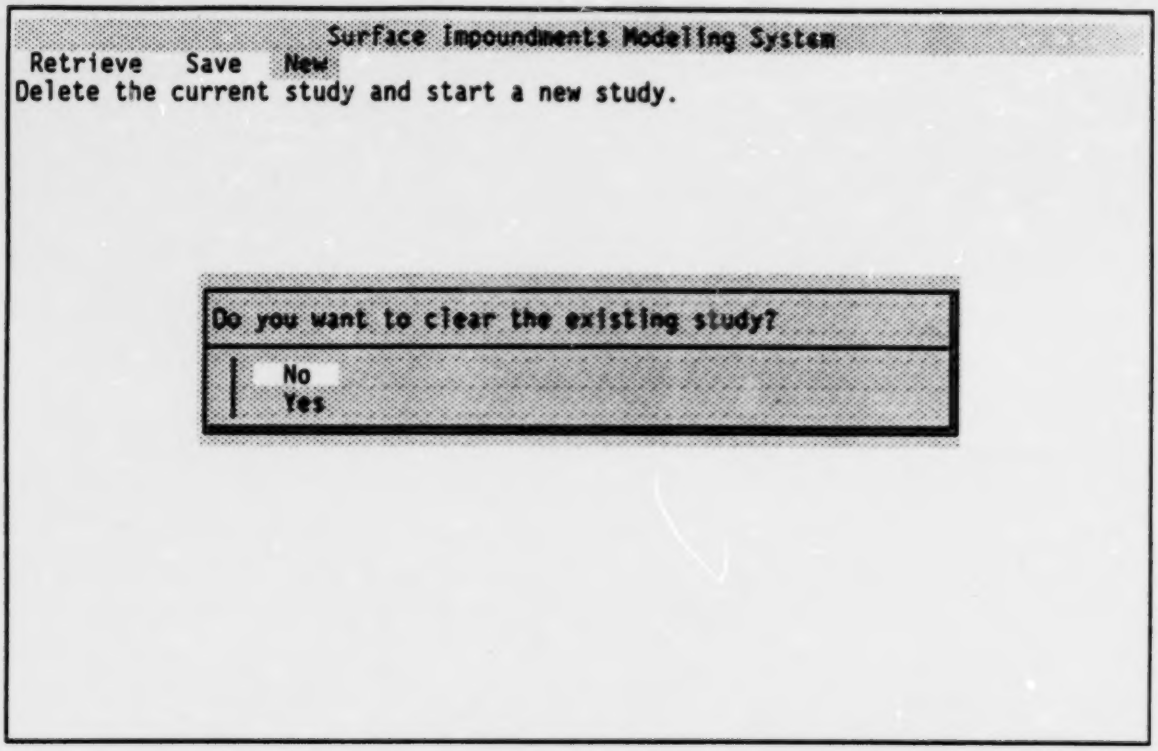
Surface Impoundments Modeling System
Retrieve Save New
Delete the current study and start a new study.
Do you want to clear the existing study?
No
Yes

Figure 3-6. Clearing an Existing Study.

option deletes the current input parameter values and resets the values to zero.

INPUT

This Main Menu entry starts a sub-menu that controls the specification of the input data for the model calculations. Figure 3-7 shows an example of the Input sub-menu. The commands available in this sub-menu are:

| | |
|---|---|
| Description | Describe the surface impoundment and supply the required input data. |
| Parameters | Review and modify the emission model input parameters. |
| Industries | Specify the industrial categories that make up the influent stream. |
| Pollutants | Review and modify the list of pollutants in the influent stream. |
| View | Displays the current study input parameter values. |

INPUT/DESCRIPTION

The Input/Description option starts the Impoundment Description data entry form as shown in Figure 3-8. SIMS uses data entry forms to obtain input values from the user. A data entry form consists of several data entry fields, each of which accepts a specific piece of information. When a data entry field is entered, a message describing the type of data to be input in the field is displayed at the bottom of the form.

There are two types of data entry fields. For the most common type, you must enter a piece of information in the field. A default value may be displayed in the field, but this value may be overwritten. If a field contains a numeric value, the contents of the field can be cleared by pressing the space bar. Numeric values must be input in the specified units of measure.

The second type of field is a select field. For this type of field, you select the desired entry by pressing the space bar to toggle through a list of possible entries.

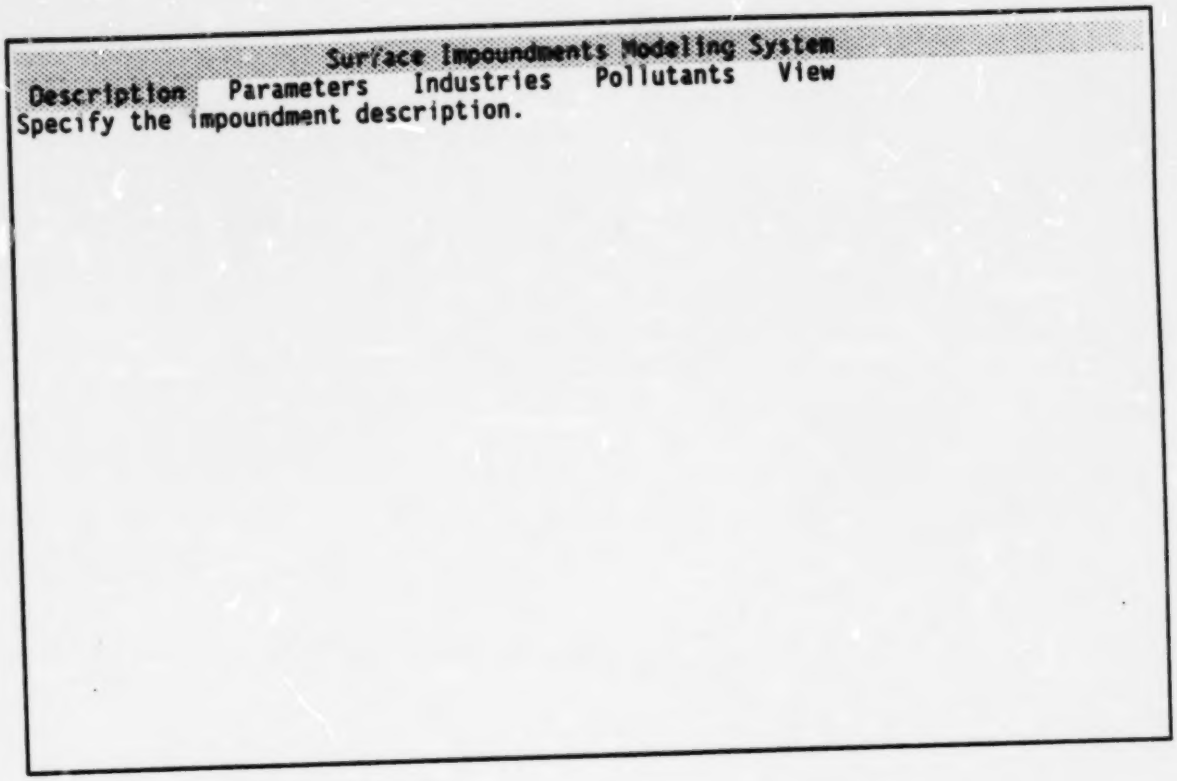
Surface Impoundments Modeling System
Description Parameters Industries Pollutants View
Specify the impoundment description.

Figure 3-7. SIMS Input Sub-menu.

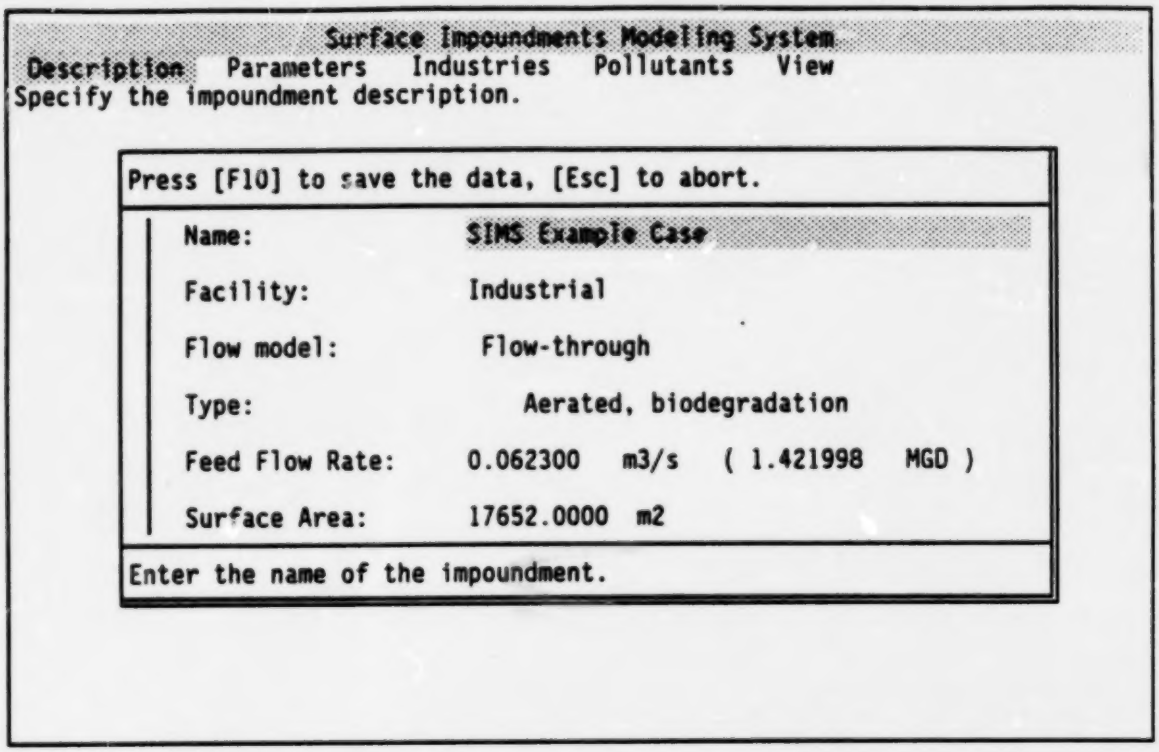
Surface Impoundments Modeling System
Description Parameters Industries Pollutants View
Specify the impoundment description.
Press [F10] to save the data, [Esc] to abort.
Name: SIMS Example Case
Facility: Industrial
Flow model: Flow-through
Type: Aerated, biodegradation
Feed Flow Rate: 0.062300 m3/s ( 1.421998 MGD )
Surface Area: 17652.0000 m2
Enter the name of the impoundment.

Figure 3-8. Describing the Impoundment.

You may move between the data entry fields by pressing [Up arrow], [Down arrow], or [Enter]. Once all of the fields in the form have been completed, you may save the changes and exit the form by pressing [F10] or, if the cursor is on the last field, by pressing [Enter]. Alternatively, you may exit the form without saving the changes by pressing [Esc].

The Impoundment Description data entry form is used to describe the surface impoundment and to supply the two required input values -- the feed flow rate and the impoundment surface area. The feed flow rate may be input either as meter$^3$/second ($m^3/s$) or million gallons/day (MGD).

From the description information, default values are calculated for all of the remaining emission model input parameters. Saving the impoundment description information resets the impoundment parameters to the calculated default values. As such, if the impoundment parameters contain existing user supplied values, SIMS will ask you to verify that the description information should be saved.

INPUT/PARAMETERS

The Input/Parameters option starts the Impoundment Parameters data entry form (see Figure 3-9). This data entry form is used to review and modify the remaining air emission model input parameters. Since the physical property data contained in the database are specified for 25°C, the ambient temperature cannot be changed. Default values for all of the fields in this form have been calculated from the information in the Impoundment Description form. As such, whenever the information in the Impoundment Description form is saved, the fields in this form are reset to the calculated default values.

The pointer in the lower left corner of the form indicates that more values occur below and that the [PgDn] key should be pressed.

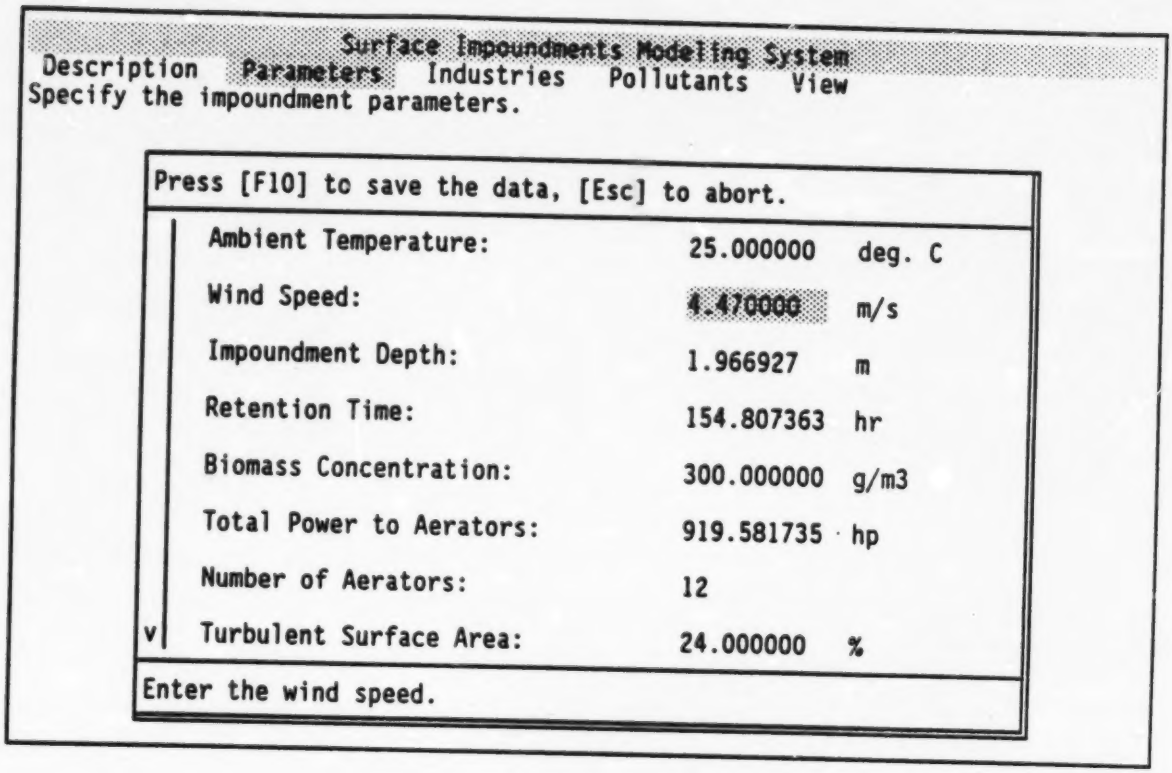
Surface Impoundments Modeling System
Description Parameters Industries Pollutants View
Specify the impoundment parameters.
Press [F10] to save the data, [Esc] to abort.
Ambient Temperature: 25.000000 deg. C
Wind Speed: 4.470000 m/s
Impoundment Depth: 1.966927 m
Retention Time: 154.807363 hr
Biomass Concentration: 300.000000 g/m3
Total Power to Aerators: 919.581735 hp
Number of Aerators: 12
Turbulent Surface Area: 24.000000 %
Enter the wind speed.

Figure 3-9. Reviewing the Impoundment Parameters.

INPUT/INDUSTRIES

In some cases, state and local regulatory personnel may not have information on the concentrations of the pollutant constituents in the feed to the impoundment. For these cases, SIMS can calculate default pollutant concentrations based on the industrial sources discharging to the impoundment.

The Input/Industries option, as shown in Figure 3-10, is used to specify the industrial sources discharging to the impoundment. The influent industries are marked with a '>'. To mark or unmark an industry, press the space bar. Once all of the influent industries have been marked, press [F10] to save the changes and exit the form.

A default list of pollutants and concentrations is prepared by SIMS based on the specified industrial sources discharging to the impoundment. Saving the information in the Industries data entry form replaces the current lists of pollutants and concentrations with a list of defaults. If the lists contain user supplied values, SIMS will ask you to verify that the information on the form should be saved.

The calculation of the default pollutant concentrations is dependent on the location of the impoundment (POTW or Industrial). Therefore, if the location of the impoundment is changed in the Impoundment Description data entry form, the default pollutant concentrations must be recalculated. This can be accomplished by selecting the Input/Industries option, marking the influent industries, and pressing [F10] to save the changes.

INPUT/POLLUTANTS

The Input/Pollutants option starts the Pollutant sub-menu. From this sub-menu, you can review and modify the list of pollutants and concentrations entering the impoundment (see Figure 3-11). The commands available in this sub-menu are:

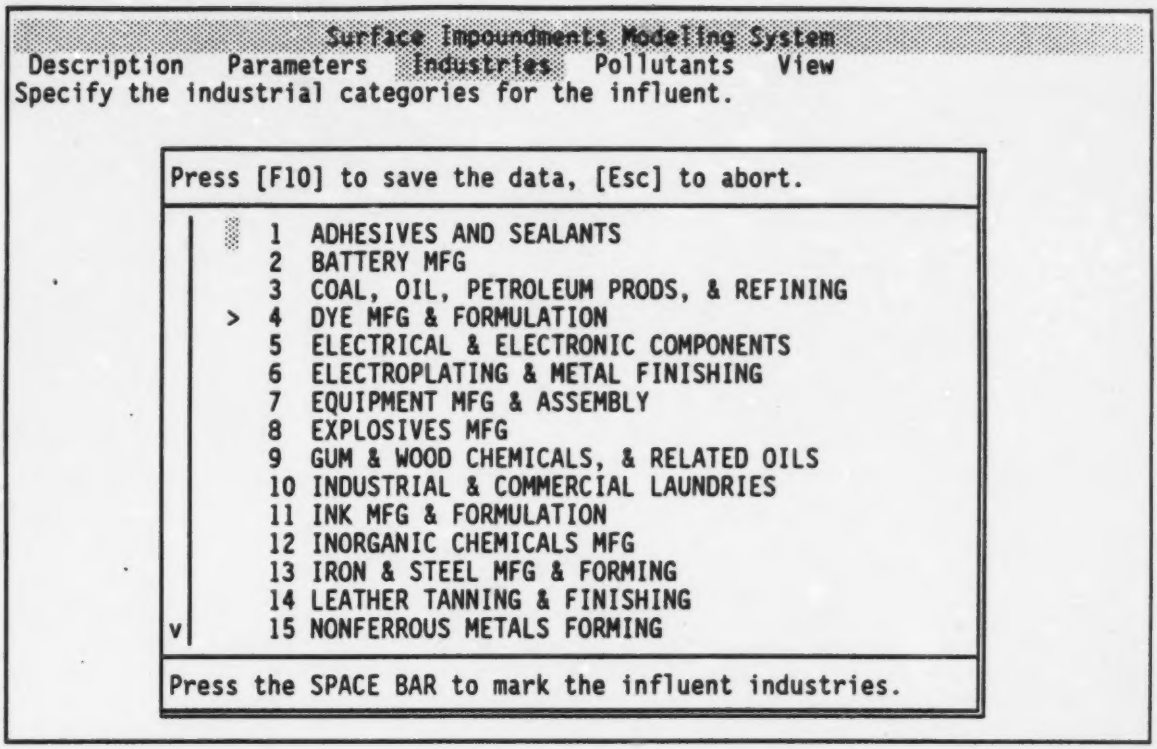
Surface Impoundments Modeling System
Description Parameters Industries Pollutants View
Specify the industrial categories for the influent.
Press [F10] to save the data, [Esc] to abort.
1 ADHESIVES AND SEALANTS
2 BATTERY MFG
3 COAL, OIL, PETROLEUM PRODS, & REFINING
> 4 DYE MFG & FORMULATION
5 ELECTRICAL & ELECTRONIC COMPONENTS
6 ELECTROPLATING & METAL FINISHING
7 EQUIPMENT MFG & ASSEMBLY
8 EXPLOSIVES MFG
9 GUM & WOOD CHEMICALS, & RELATED OILS
10 INDUSTRIAL & COMMERCIAL LAUNDRIES
11 INK MFG & FORMULATION
12 INORGANIC CHEMICALS MFG
13 IRON & STEEL MFG & FORMING
14 LEATHER TANNING & FINISHING
v 15 NONFERROUS METALS FORMING
Press the SPACE BAR to mark the influent industries.

Figure 3-10. Selecting the Industries Discharging to the Impoundment.

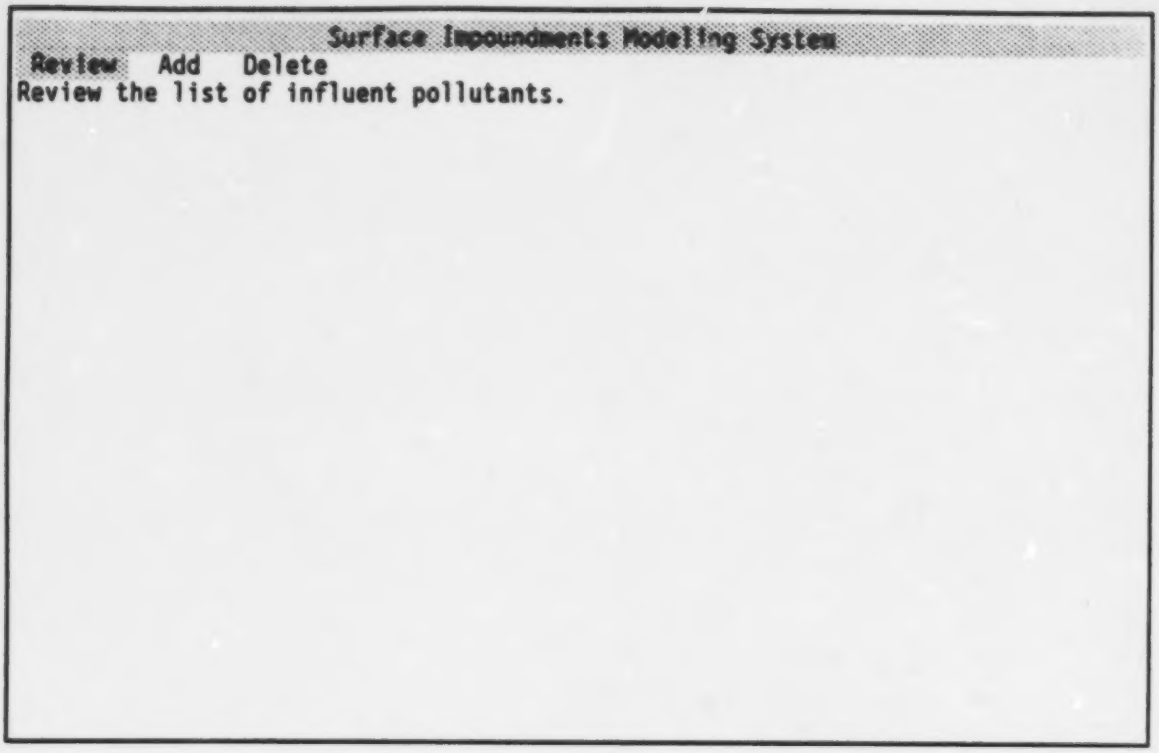


Figure 3-11. SIMS Pollutants Sub-menu.

| | |
|---|---|
| Review | Review the current list of influent pollutants and modify their associated concentrations. |
| Add | Add a pollutant to the current list of influent pollutants. |
| Delete | Delete a pollutant from the list of influent pollutants. |

Default values for the list of pollutants and concentrations are calculated from the information in the Industries data entry form. As such, whenever the information in the Industries form is saved, the current list of pollutants and concentrations is replaced with a list of defaults.

INPUT/POLLUTANT/REVIEW

This option starts the data entry form as shown in Figure 3-12. The current list of influent pollutants is displayed along with the total inlet concentrations. The values in the concentration data entry fields may be modified. Press [F10] to save the changes and exit the form.

INPUT/POLLUTANT/ADD

This option starts the pop-up menu presented in Figure 3-13. This pop-up menu presents the pollutants defined in the SIMS database that have not been included in the list of influent pollutants. Select the pollutant you wish to add to the influent stream. After a pollutant is selected, you will be asked to enter the influent concentration for the pollutant (see Figure 3-14).

INPUT/POLLUTANT/DELETE

This option starts the pop-up menu presented in Figure 3-15 and is used to delete pollutants from the influent list. Select the pollutants you wish to delete. SIMS asks if you are sure you want to remove the pollutant before the deletion is completed.

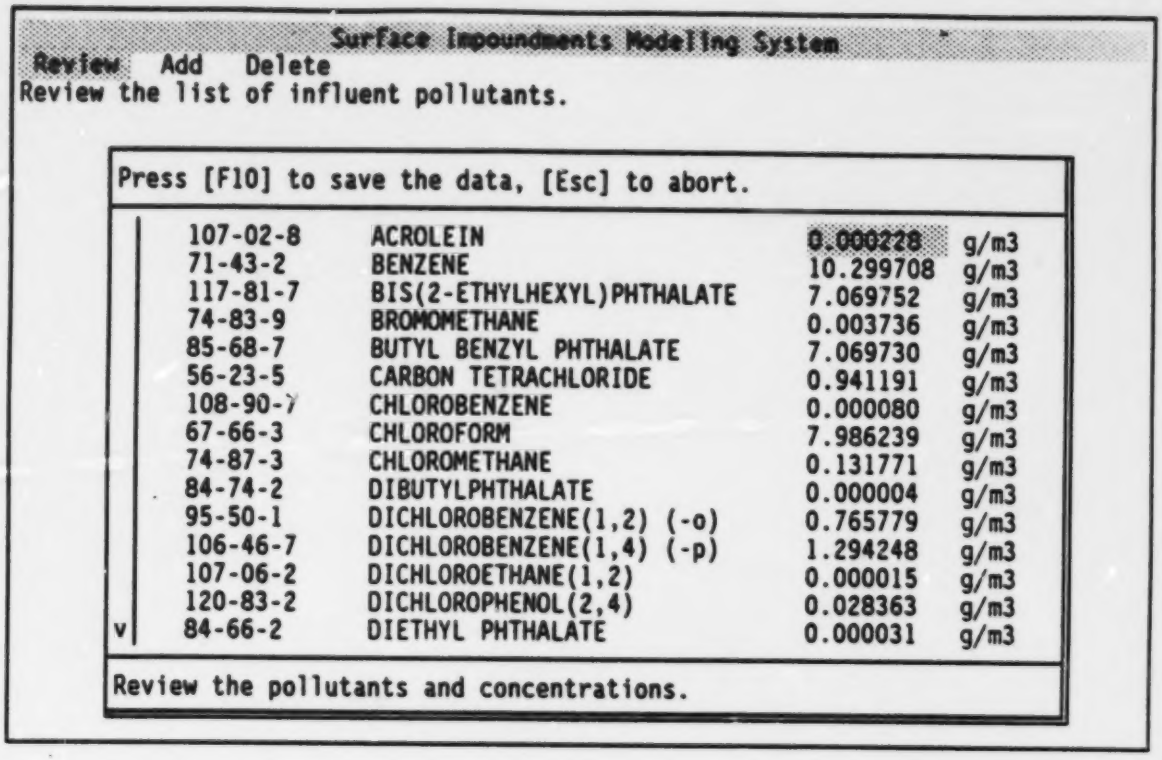
Surface Impoundments Modeling System
Review Add Delete
Review the list of influent pollutants.
Press [F10] to save the data, [Esc] to abort.
107-02-8 ACROLEIN 0.000228 g/m3
71-43-2 BENZENE 10.299708 g/m3
117-81-7 BIS(2-ETHYLHEXYL)PHTHALATE 7.069752 g/m3
74-83-9 BROMOMETHANE 0.003736 g/m3
85-68-7 BUTYL BENZYL PHTHALATE 7.069730 g/m3
56-23-5 CARBON TETRACHLORIDE 0.941191 g/m3
108-90-7 CHLOROBENZENE 0.000080 g/m3
67-66-3 CHLOROFORM 7.986239 g/m3
74-87-3 CHLOROMETHANE 0.131771 g/m3
84-74-2 DIBUTYLPHTHALATE 0.000004 g/m3
95-50-1 DICHLOROBENZENE(1,2) (-o) 0.765779 g/m3
106-46-7 DICHLOROBENZENE(1,4) (-p) 1.294248 g/m3
107-06-2 DICHLOROETHANE(1,2) 0.000015 g/m3
120-83-2 DICHLOROPHENOL(2,4) 0.028363 g/m3
v 84-66-2 DIETHYL PHTHALATE 0.000031 g/m3
Review the pollutants and concentrations.

Figure 3-12. Reviewing the .ist of Influent Pollutants.

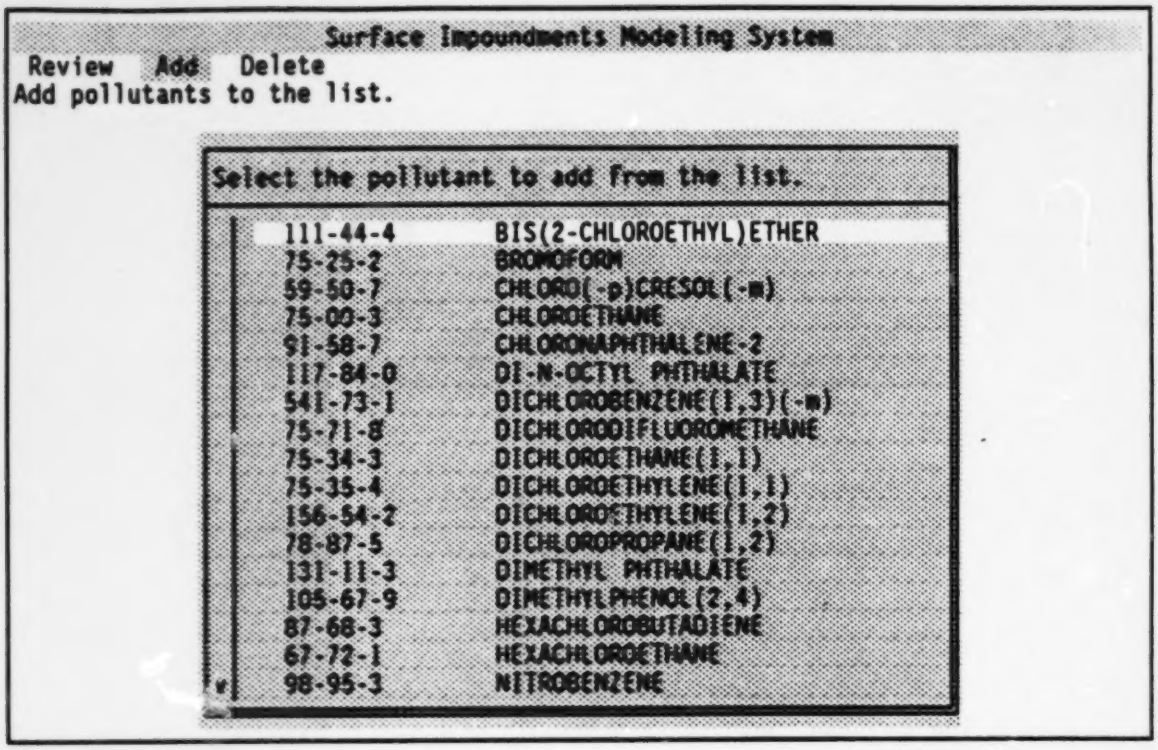


Figure 3-13. Adding a Pollutant to the Influent Pollutant List.

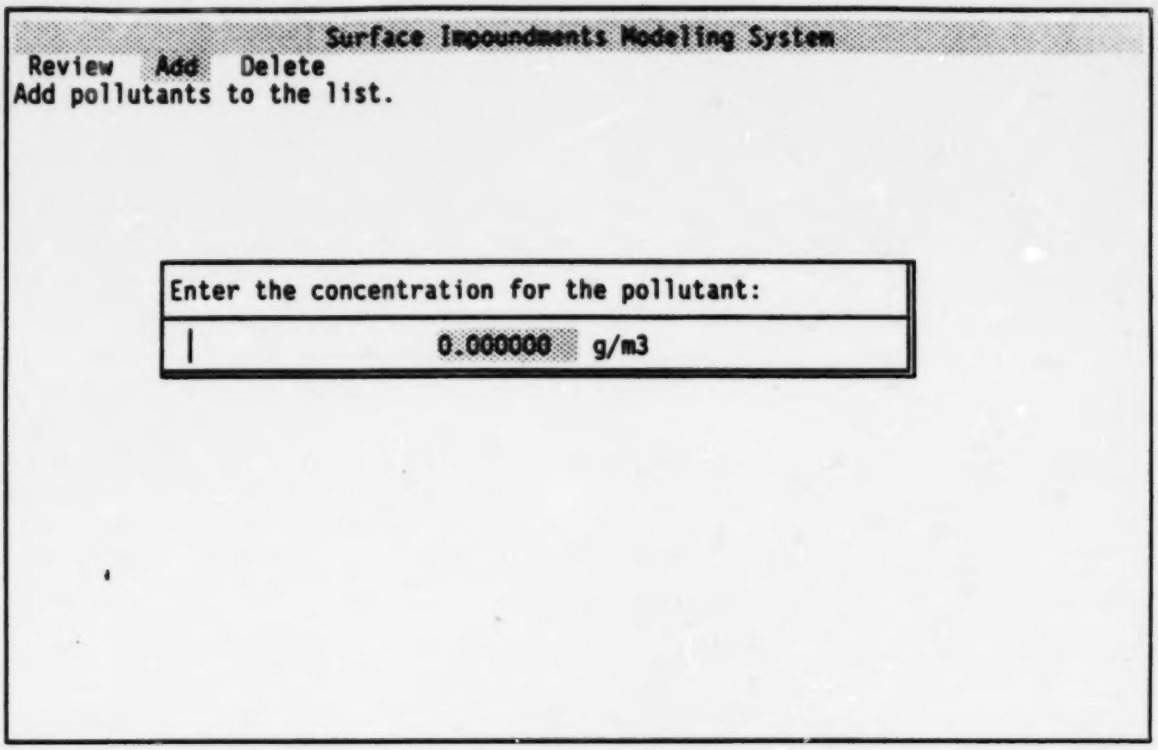
Surface Impoundments Modeling System
Review Add Delete
Add pollutants to the list.
Enter the concentration for the pollutant:
0.000000 g/m3

Figure 3-14. Entering the Concentration for an Added Pollutant.

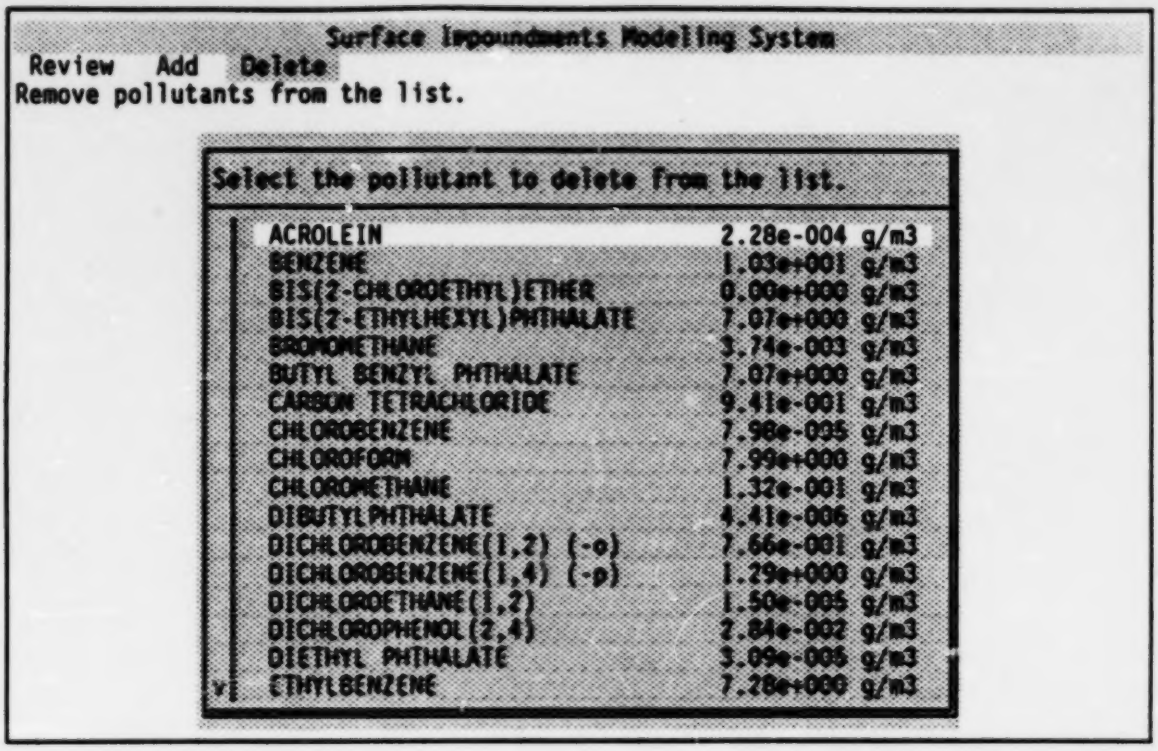


Figure 3-15. Removing Pollutants from the Influent Pollutant List.

INPUT/VIEW

Input/View allows you to review the current values for all of the input parameters. These values are presented in the report format shown in Figure 3-16. The text of the report can be scrolled using the cursor motion keys. [Home] moves to the beginning of the text and [End] moves to the end. [PgUp] and [PgDn] move the text up a page or down a page, respectively. The pointer in the lower left corner of the display indicates that more text occurs below and that the [PgDn] key should be used to view it. When you have finished viewing the input value report, press [Esc] to return to the Input sub-menu.

CALCULATE

This Main Menu entry performs the air emission estimates for the defined surface impoundment. Before the calculation is performed, SIMS checks that all of the input values are non-zero. If zero values are found, a warning message is displayed. If the input values are acceptable, SIMS asks if you are ready to calculate the emission estimates (see Figure 3-17). After the calculations have been completed, a report of the air emission estimates is displayed (see Figure 3-18). Use the cursor motion keys to scroll through the report and press [Esc] to exit.

PRINT

This Main Menu option generates a report of the air emission estimates for the defined surface impoundment. As shown in Figure 3-19, the report can be sent either to the printer or to a file. Check that your printer is on and that it has paper before you send the report to the printer. If you select to send the report to a file, SIMS will prompt for the file name. If the specified file exists, SIMS will ask if you want to overwrite the existing file.

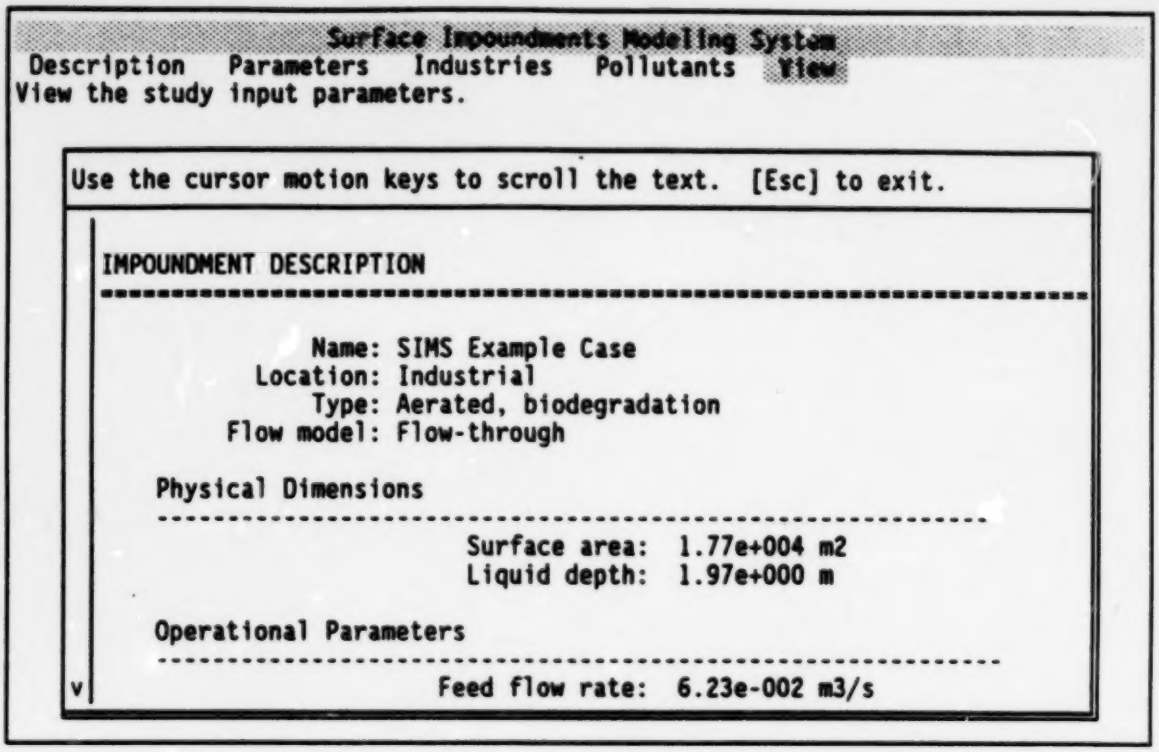
Surface Impoundments Modeling System
Description Parameters Industries Pollutants View
View the study input parameters.
Use the cursor motion keys to scroll the text. [Esc] to exit.
IMPOUNDMENT DESCRIPTION
Name: SIMS Example Case
Location: Industrial
Type: Aerated, biodegradation
Flow model: Flow-through
Physical Dimensions
Surface area: 1.77e+004 m2
Liquid depth: 1.97e+000 m
Operational Parameters
Feed flow rate: 6.23e-002 m3/s

Figure 3-16. Viewing the Current Input Parameter Values.

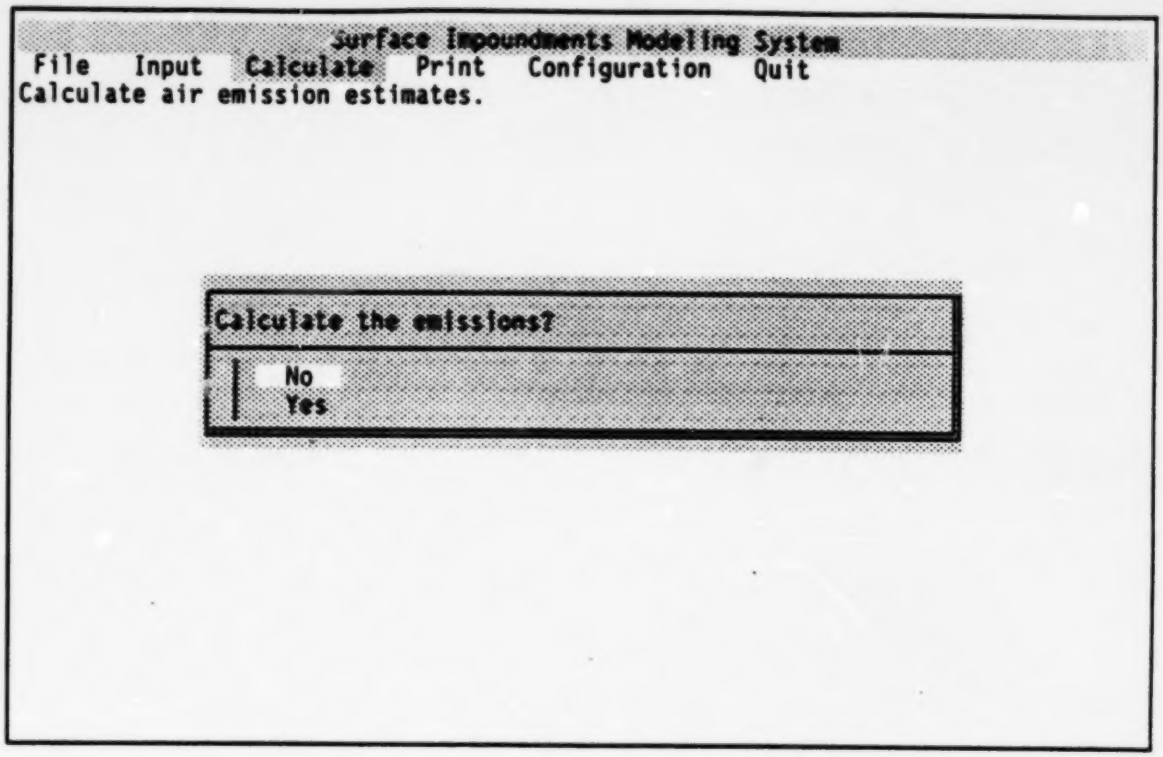


Figure 3-17. Preparing to Calculate the Air Emissions.

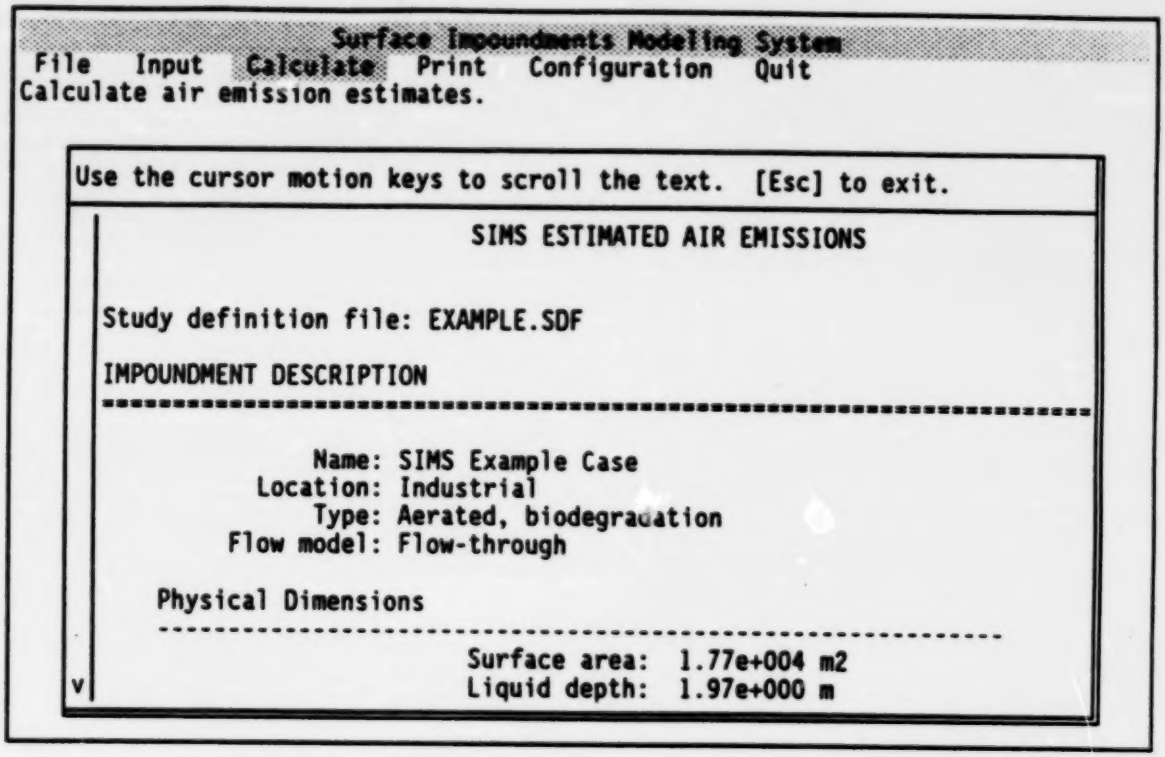
Surface Impoundments Modeling System
File Input Calculate Print Configuration Quit
Calculate air emission estimates.
Use the cursor motion keys to scroll the text. [Esc] to exit.
SIMS ESTIMATED AIR EMISSIONS
Study definition file: EXAMPLE.SDF
IMPOUNDMENT DESCRIPTION
Name: SIMS Example Case
Location: Industrial
Type: Aerated, biodegradation
Flow model: Flow-through
Physical Dimensions
Surface area: 1.77e+004 m2
Liquid depth: 1.97e+000 m

Figure 3-18. Results of the Air Emission Calculations.

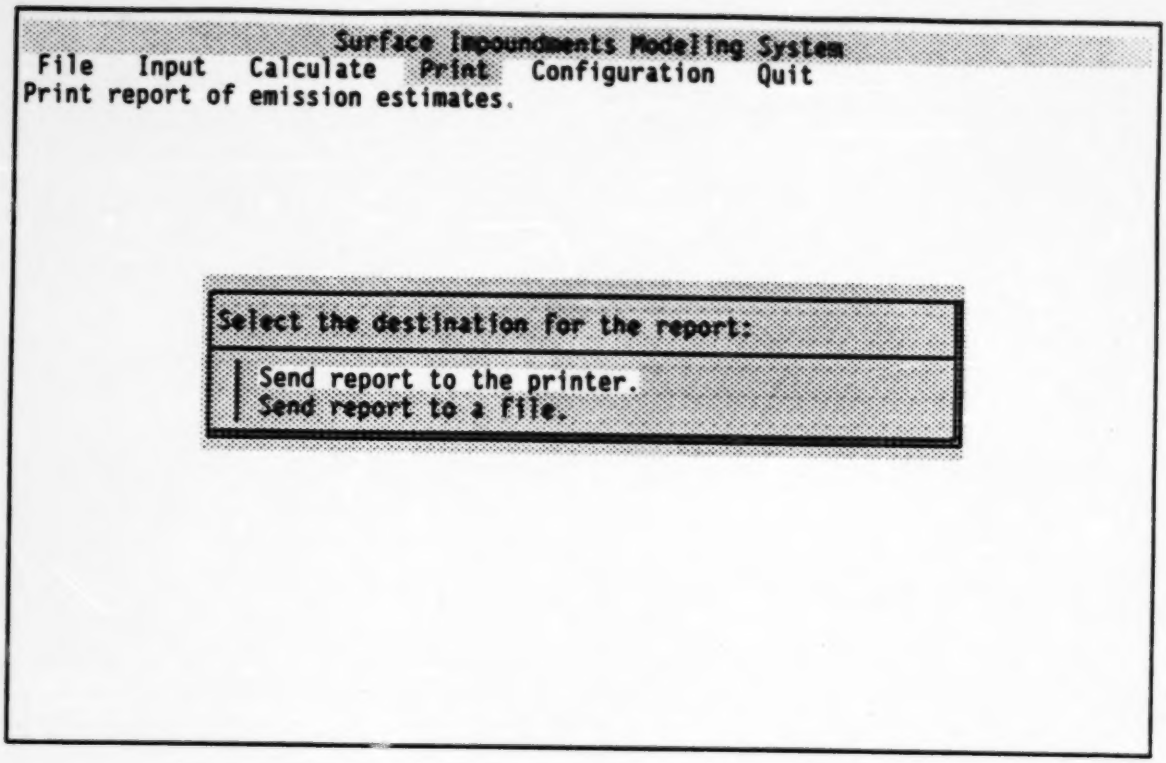
Surface Impoundments Modeling System
File Input Calculate Print Configuration Quit
Print report of emission estimates.
Select the destination for the report:
Send report to the printer.
Send report to a file.

Figure 3-19. Preparing to Print the Air Emission Report.

## CONFIGURATION

The Configuration option starts the SIMS Configuration Parameters data entry form (see Figure 3-20). This form allows you to set the following configuration parameters used by SIMS:

- Default directory;
- Printer port;
- Printer setup string;
- Page margins; and
- Page length.

Setup strings for your printer can be found in the printer's manual. Typically, the string will contain several control characters that can be represented as \nnn (a backslash followed by a 3 digit number).

The updated parameters may be saved in the SIMS configuration file for use in future sessions.

## QUIT

The Quit option from the Main Menu exits SIMS and returns to DOS. As shown in Figure 3-21, SIMS will ask you if you really want to quit and will remind you if you have not saved your input values.

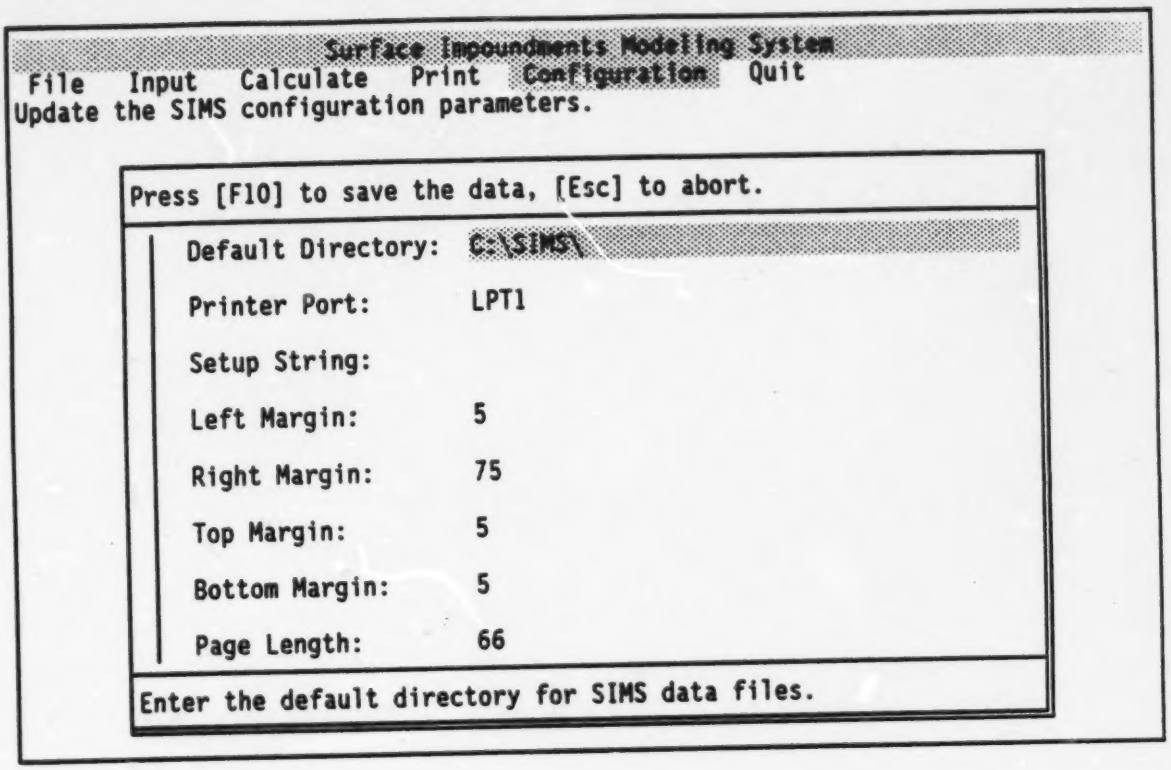
Surface Impoundments Modeling System
File Input Calculate Print Configuration Quit
Update the SIMS configuration parameters.
Press [F10] to save the data, [Esc] to abort.
Default Directory: C:\SIMS\
Printer Port: LPT1
Setup String:
Left Margin: 5
Right Margin: 75
Top Margin: 5
Bottom Margin: 5
Page Length: 66
Enter the default directory for SIMS data files.

Figure 3-20. Setting the SIMS Configuration Parameters.

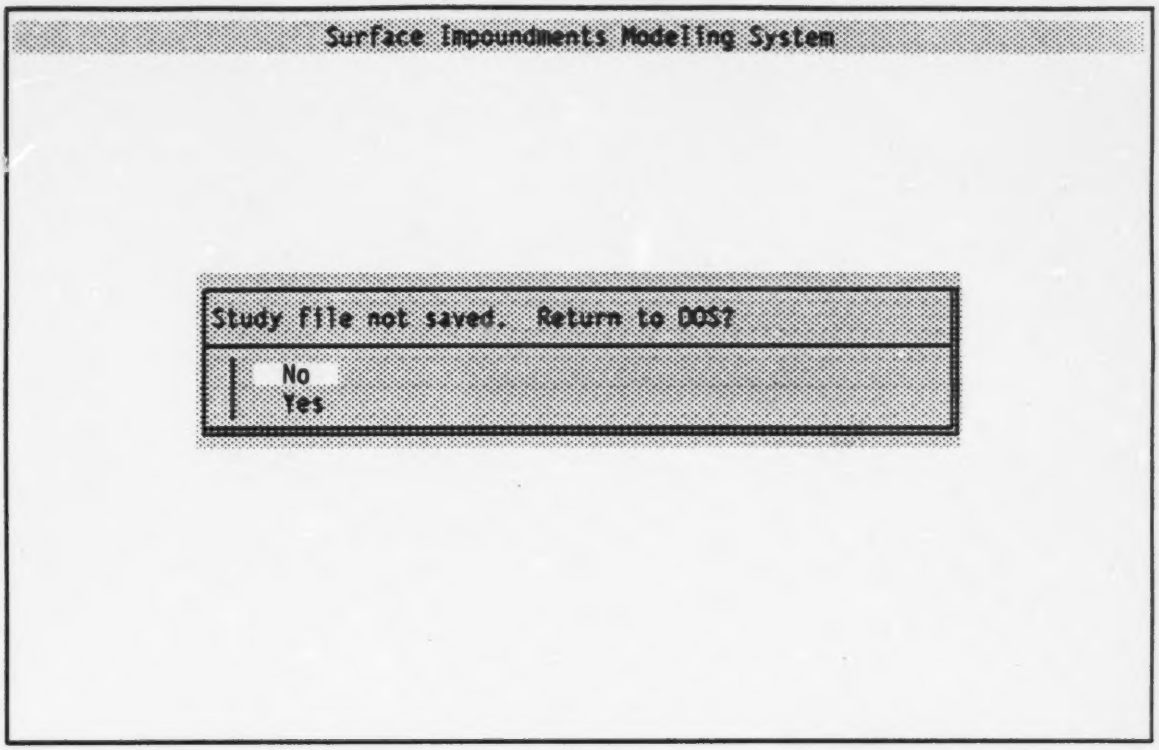


Figure 3-21. Exiting SIMS.